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AUTHOR Thurlow, John P.
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ABSTRACT

This paper presents a model for professional development that is site-based and utilizes a Teacher-Mentor approach for technology training. To guide the development of such models for schools, the paper discusses the following principles: (1) the Teachers Computer Ability Profile (TCAP), a straightforward instrument teachers can use to self-assess their skills in seven areas of technology use; (2) the Individualized Professional Development Plan;(3) benefits of the Teacher-Mentor Model; (4) seven essential elements of a comprehensive teacher-mentor professional development model; (5) student involvement in the school's model; (6) development of a training curriculum; and (7) evaluation methods. Included at the end of the paper are: a diagram of the Professional Development Model, Teachers Computer Ability Profile, and online resources for technology planners. (AEF)

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TEACHERS AS TECHNOLOGISTS

Professional Development for Technology Integration

John P. Thurlow
South Portland Public Schools
South Portland, Maine

International Reading Association
Presented May 4, 1999

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TEACHERS AS TECHNOLOGISTS

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THE NEED FOR PROFESSIONAL DEVELOPMENT IN TECHNOLOGY

Louis Gerstner, CEO of IBM stated, "Information technology is the force that revolutionizes business, streamlines government and enables instant communications and the exchange of information among people and institutions around the world. If technology becomes widely infused in schools, it seems probable that it can play analogous roles in education" (RAND, 1998). Technology can be the revolutionary force that instigates and supports reform by teachers and administrators at the school level (RAND, 1998). The one critical impediment to that goal, however, is the professional development of teachers as users of technology who effectively integrate information technology with the best of pedagogy (Papert, 1993).

Federal legislation in recent years has emphasized the importance of educational technology and leaders have called for action to ensure the access of all schools to the national information infrastructure (RAND, 1998). This has resulted in significant appropriations for technology and major changes associated with the growth of information technology are clearly under way in our schools. Despite over a decade of investment

in educational hardware and software, however, relatively few of the nation's 2.8 million teachers use technology in their teaching (U.S Congressional Office of Technology Assessment, 1995).

At the same time much of America is in the midst of significant efforts to reform and improve the performance of its educational system. The educational standards movement has spread throughout the country as state governments and communities embrace higher standards and improved practices that enable virtually all students to meet the demands of an information-based world. Technology education is a critical component of these reform efforts but in order to achieve the goals of integrating technology and learning, teachers must be equipped with the skills to use the tools and integrate them with instruction. America's schoolteachers are not prepared to do so.

A recent survey by the U. S. Department of Education demonstrates the dismal state of affairs relative to teacher training in technology integration. The study reported that only 20 percent of teachers reported feeling very well prepared to integrate educational technology into classroom instruction (1998). A study by Knirk in 1989 found that less than one-third of all K-12 teachers had even ten hours of computer training, and almost two-thirds of the states were financially unable to provide for additional training and support of educational computing (Knirk, 1989). A national survey by Educational Testing Service six years later found similar results reporting that only 15 percent of teachers nationwide had received at least nine hours of training in educational technology (Coley, 1997). That is a relative decline at a time when technology investments have increased dramatically (U.S Congressional Office of Technology Assessment, 1995). Furthermore, most schools spend less than 15 percent of their technology budgets on training, only half of the federally recommended amount. In 18 states teacher education students are not required to take courses in

educational technology to obtain a teaching license (Coley, 1997).

There is an urgent need for professional development programs directed towards helping teachers adjust to the new challenges presented by technology. If technology integration programs are to succeed, teachers must be provided high quality training that gives them the confidence and skills to use technology effectively (Houghton, 1997). The importance of such training has been documented by empirical research conducted in California schools that were the recipients of technology grants. The study concluded that 30 percent of any educational technology budget should be earmarked for teacher development with follow up support and assistance (Coley, 1997).

Technology has the potential of positively impacting all content areas, particularly mathematics where abundant applications are available to support classroom instruction. Research shows that helping teachers learn how to integrate technology into their math curriculum is a critical factor for the successful implementation of technology in schools (U.S Congressional Office of Technology Assessment, 1995).

The need for reform in mathematics education has also been well established (NCTM, 1989; National Research Council, 1989). States across the nation are implementing learning standards which call for higher expectations for student performance in mathematics. Furthermore, studies have pointed to the need for greater attention to math concepts and application of those concepts to real-world problems. Computation and rote memorization of facts and algorithms have predominated math instruction for decades. An integrated approach which focuses on problem solving in real-world contexts has been proven more effective than the traditional drill and practice methodology of the past (NCTM, 1989). Technology integration supports these approaches.

Concurrent with the demands being placed on mathematics educators is the goal of integrating technology in every aspect of education. Computers are now being viewed as tools children should use as resources for information, communications and self-directed learning. There are, however, very few examples of schools with large numbers of classrooms incorporating technology-supported constructivist teaching and learning approaches (Means & Olson, 1995).

Models of excellence for teacher training in technology are also difficult to locate in the literature. Empirical studies need to be undertaken to assess the impact of technology integration on student achievement. New research designs, therefore, are needed to demonstrate the effectiveness of such programs and to alert policy makers of the need to equip teachers with the skills they need to integrate technology effectively.

Will effective teacher training in the use of technology integration practices result in significantly positive gains in student achievement? That will depend upon the nature of the training models. Many in-service models focus on equipping teachers with basic skills using hardware and productivity software rather than curriculum-based applications and strategies for integrating them in their instructional activities (Benson, 1997). Effective professional development provides a balanced approach which equips teachers with basic technical abilities as well as strategies for curriculum integration and management. This requires thoughtful planning and attention to teachers' needs because they are being asked to engage in the process of acquiring technical skills unlike any they've been asked to learn before. This can be overwhelming for many teachers.

A MODEL FOR PROFESSIONAL DEVELOPMENT

What follows is a model for professional development that is site-based and utilizes a Teacher-Mentor approach for technology training. The principles outlined below can guide the development of models for most schools.

TEACHERS COMPUTER ABILITY PROFILE

Teachers, like their students, have diverse backgrounds in using technology. The first step in developing an in-service program is to assess teachers' prior knowledge and technical abilities. There are many surveys available for this purpose. The Teachers Computer Ability Profile (TCAP) is a straightforward instrument teachers can use to self-assess their skills in seven areas of technology use; 1) basic computer skills, 2) managing files, 3) word processing, 4) use of productivity software, 5) use of multimedia and educational software, 6) knowledge of networking and the Internet and, 7) curriculum integration practices (Thurlow, 1999). Each category details competency rubrics for each of five general skill levels (non-user, novice, basic, advanced and expert). Teachers can self-administer the instrument in five minutes to determine their Profile Score and level of proficiency. The TCAP includes an open-ended question to ascertain teachers' interest in developing their skills through professional development. This information can be used to develop teachers' Individualized Professional Development Plans. It is important to consider teachers' interests in this regard to prevent the practice of forced training for those who are not yet comfortable with technology.

Administration of the TCAP will produce groupings of teachers in each of the five ability levels mentioned above. From

those groups administrators or technology coordinators can facilitate training for teachers in those groups who are at similar levels of ability. This model acknowledges that the acquisition of technical skills requires mastery of certain prerequisite skills. Teachers who are non-users, novices or basic users will need instruction in a hierarchy of skills before they can become trained in more advanced applications and curriculum integration strategies.

INDIVIDUALIZED PROFESSIONAL DEVELOPMENT PLAN

While the TCAP provides a general level of proficiency with which to group teachers for professional development activities, the design of a staff development plan should be individualized. It is likely that many teachers will be at similar levels in their experience, competence and comfort, so designing courses for teacher groups is made easier through classification by the TCAP. But like their students, teachers learn at different rates and invest differently in their own learning. Those differences are acknowledged through the Individualized Professional Development Plan which allows the training to be customized and self-paced. Teachers who move rapidly through the sequence of skills presented in training groups can be reassessed and classified at a higher level of proficiency where new training opportunities await them.

THE TEACHER-MENTOR MODEL

How can staff development for technology be individualized when there are so many teachers to train and so many skills to acquire? That question requires a professional development paradigm that utilizes Teacher-Mentors at individual buildings to provide group and individual training.

Teacher mentoring has long been recognized as an effective model for initiating classroom change (Joyce & Showers, 1988, cited in Fleming). But despite the demonstrated effectiveness of the model it has not been widely used. A recent national survey indicated that only 19 percent of the teacher respondents had been mentored by another teacher in a formal relationship. Of those who were mentored at least once a week, 70 percent reported that it improved their teaching significantly. Furthermore, teachers surveyed perceived relatively strong collegial support for their work; 63 percent strongly agreed that other teachers shared ideas with them that were helpful in their teaching (National Center for Education Statistics, 1998).

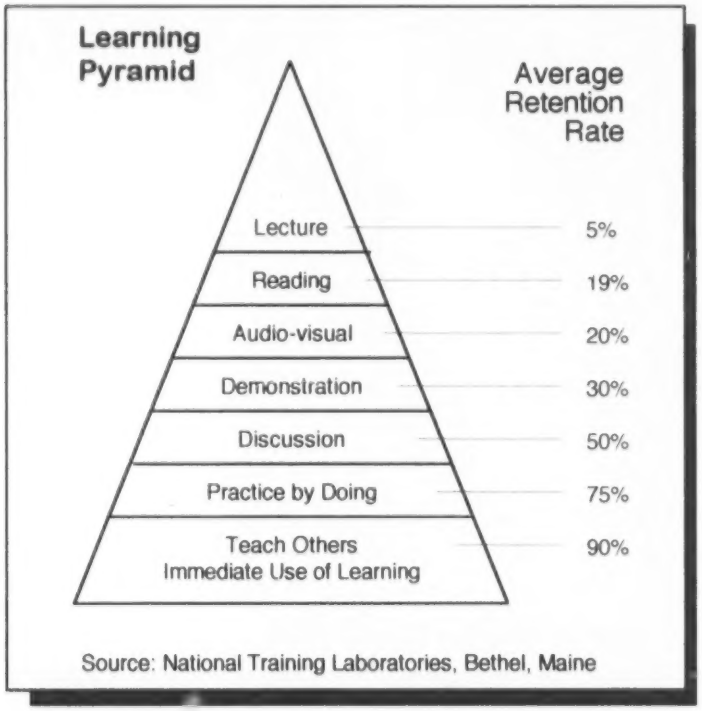
Teachers are often the best providers of in-service experiences for several reasons. First, teachers at the building level generally have a close working relationship with their colleagues. Secondly, personal relationships develop at the school level and extend beyond the school day where informal support can occur. Teachers are also collaborating more in team teaching situations where they plan curriculum together. Also, more time can be devoted to in-service at the school level. Finally, with the rapid appearance of computers in daily life, it is likely that most schools will have at least one teacher who is well versed in technology and could provide in-service at the building level as a mentor. These factors all support the need for technology in-service to be accomplished primarily at the building level.

Another benefit of the teacher-mentor model is that all teachers are potential mentors. Using the TCAP instrument, teachers who are identified as Level 2 Novices by the TCAP, for example, can be instructed by willing Teacher-Mentors who are at Levels 4 or 5. As staff development opportunities proceed, teachers are reassessed and reclassified using the TCAP or other measures based on their newly acquired skills. This will result in

an ever-increasing pool of Teacher-Mentors as more and more teachers become better trained.

An additional benefit of the model is that the mentors themselves will refine their own skills and have greater retention as they apply them when teaching their colleagues (Figure 1, National Testing Laboratories).

Figure 1



We know from research on adult learning that educators have varying needs, learn in different ways, and bring different skills and experiences to the learning situation, factors not unlike those of their students. As with the instruction of children, professional development activities must be tailored to fit the participants. Who better to plan for such diversity than those

who do it every day in their own classrooms? Incorporating strategies geared toward adult learners, such as observing, mentoring, coaching, and reflecting enhances the professional development experience (Fleming, 1999).

The Teacher-Mentor model provides an additional advantage in that teachers are likely to generate curriculum ideas as they learn together under the leadership of their mentor. This will be particularly true if the mentor is part of a teaching team that ordinarily plans units of instruction collaboratively.

ESSENTIAL ELEMENTS OF A COMPREHENSIVE MODEL

Many teachers are just as intrigued with technology as their students are and many are willing to make an investment in their own development. They recognize that technology is changing rapidly and its movement into the classroom is inevitable. But the greatest impediment to learning both the technical skills and pedagogical strategies is time. It takes an enormous amount of time to learn and practice the intricacies of computers which have become so advanced in recent years. If teachers are going to make a commitment to technology integration then districts need to provide incentives and resources for them to develop their skills as well as rewards for the tremendous effort required to develop them. There are seven essential elements of a comprehensive teacher-mentor professional development model:

- Release time during the school year or paid training during vacations or the summer to train.
- Access to hardware and software for practicing skills, including loans of equipment for use at home and access to labs or workstations.

- Financial incentives and rewards including training stipends and course reimbursement.

- Generous continuing education credits and certification endorsements.

- Hardware and software for their classrooms once they are trained so they can continually apply their skills and integration strategies.

- Accessible technical support for troubleshooting.

- Follow-up training sessions and ongoing mentor support.

Mentors must also be well compensated and receive similar incentives and rewards as their colleagues who are in training. This model can be very cost-effective since a great deal of informal training will occur throughout the school year as part of the regular school day as mentors and teachers encounter new challenges. Consider the costs involved if technology trainers were employed to meet the same training challenges.

STUDENT INVOLVEMENT

A final component of the Teacher-Mentor model involves students in the process. Many children are so well-versed in the use of computers that they could be classified as "experts" using criteria from the TCAP. Mentors and teachers in training can take advantage of students' skills and willingness to share their knowledge by inviting them into the process. Furthermore, it is important to ensure that teacher training is field-based; that is, teachers should have many opportunities to apply their skills directly with students during the training sessions. The nature of

student involvement in the school's model will depend on many factors including the students' maturity levels and competencies. Those details are best decided at the site, but students should play a part of any model.

CURRICULUM

Development of a training curriculum is an essential task for local site managers to undertake. The Teachers Computer Ability Profile provides general direction for a training curriculum, but as with other aspects of the design the specific training goals and objectives are best developed on-site. Factors such as available hardware and software resources, district curriculum standards, existing technology plans and mentor expertise will affect the nature of the curriculum that is developed. The training curriculum should be flexible to accommodate individual teacher's Professional Development Plans.

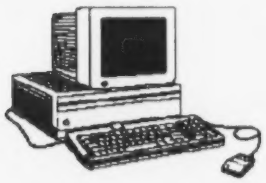
EVALUATION

A plan for conducting formative and summative evaluations is recommended for schools to document the success of their professional development activities. The nature of the evaluation methods is best determined on-site but should include teacher and mentor feedback, ethnographic data from observations of classroom instruction, and data relative to student outcomes.

SUMMARY

There is a significant need for effective professional development of teachers as technology users. A model for staff development has been presented which is site-based, individualized, utilizes Teacher-Mentors to train and inspire their colleagues, offers incentives and rewards, and includes students in the process. Suggestions for developing local training curriculum and program evaluation tools are included. The principles of the model can be incorporated into most schools' professional development programs for technology.

TEACHERS AS TECHNOLOGISTS



PROFESSIONAL DEVELOPMENT MODEL

Assess Teachers' Abilities

- Teachers Computer Ability Profile

Plan For Professional Development

- Individualized Professional Development Plan
- School or District Training Curriculum

Provide Professional Development

- On-Site Group Instruction By Mentors (at TCAP Levels)
- Individual Instruction By Teacher-Mentors
- Training Experiences In the Classroom
- Student Involvement In Teacher Development

Furnish Necessary Resources

- Release Time
- Paid Summer Training
- Access to Hardware and Software
- Equipment Loans for Use at Home
- Financial Incentives Training Stipends
- Continuing Education Credits
- Certification Endorsements
- Hardware and Software Additions to the Classroom
- Technical Support
- Follow-up Training
- Ongoing Mentor Support

JOHN P. THURLOW
SCARBOROUGH, MAINE

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Program Evaluation

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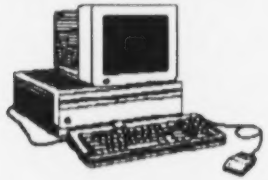
TEACHERS COMPUTER ABILITY PROFILE

JOHN P. THURLOW
SCARBOROUGH, MAINE



Please read each description to assess your current ability using computers. Place the number of the level for each category in the box on the left. Then add the numbers in all seven boxes and calculate the Profile Score on the last page. You may use .5 to place yourself between two levels.

BASIC COMPUTER SKILLS

LEVEL	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5
	• Do not use a computer.	• Have limited experience with a computer. • Can run some basic programs. • Computer has little effect on work or family life.	• Use the computer for basic tasks such as word processing. • Can save, open and print files. • Able to use CD-ROM and basic Internet browsers.	• Can set-up a computer, load software and use many programs. • Can use most features of the computer's operating system. • Can teach or help others use their computer.	• Advanced and frequent user. • Can run multiple programs, customize the interface, and use advanced features of the operating system and many applications.

MANAGING COMPUTER FILES

LEVEL	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5
	• Do not know how to create or save files on the computer.	• Can create and save some files. • Unsure where the files are saved or how to retrieve them.	• Can create and save files and understand how the file saving directory works. • Can save to a hard drive or a floppy disk or other media.	• Have an organized filing system for files. • Can retrieve files quickly. • Know how to back up files. • Can teach others how to effectively manage files.	• Can manage files at an advanced level. • Can back up files using software applications. • Can transfer & translate files between platforms and over a network.

USING WORD PROCESSING SOFTWARE

LEVEL	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5
	• Do not know how to word process.	• Can use a word processor to compose basic documents. • Can modify documents and use again. • Can save files.	• Use a word processor frequently. • Can use word processing formatting features such as fonts and styles. • Can use basic software tools such as spell-checking.	• Use word processing frequently in school and home. • Know advanced features of word processing programs. • Can use word processing for a variety of document types.	• Advanced user of word processing software. • Can integrate word processing into other applications. • Can teach others how to use word processing applications to improve written communications.

USE OF OTHER SOFTWARE

Graphics • Spreadsheet • Database • Presentation Software

LEVEL	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5
	• Do not know how to use graphics, spreadsheets, database or presentation programs.	• Have some very limited experience using one or more of these applications.	• Can use one or more of these applications at a basic level. • Can create files and use basic features.	• Can use all of these applications at a basic level. • Use one or more fairly frequently. • Can teach others basic features of each one.	• Advanced user of two or more of the applications. • Can integrate these applications to create dynamic files. • Can teach others how to use these applications for a variety of purposes.

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USE OF MULTIMEDIA CD-ROM AND EDUCATIONAL SOFTWARE

LEVEL	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5
	• No experience with these types of programs.	• Have some very limited experience with this type of software. • Can use CD-ROM products to a limited degree.	• Basic skills in the use of CD-ROM programs or other educational software. • Able to install CD-ROM programs and customize them.	• Frequent user of multimedia programs on CD-ROM. • Effective user of these applications in the classroom. • Can teach others to use these programs.	• Advanced user of multimedia. • Frequent user of multimedia at home or in the classroom. • Can integrate the use of multimedia for instruction.

USE OF THE INTERNET E-mail • World Wide Web • Newsgroups

LEVEL	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5
	• No experience with the Internet.	• Have some very limited experience with the Internet. • Have a basic understanding of how the Internet works. • Have seen examples of web sites and e-mail.	• Have access to an Internet connection. • Use e-mail. • Can navigate the World Wide Web with a browser. • Can use basic services of a network provider such as AOL.	• Frequent user of e-mail, the World Wide Web and other Internet services. • Can search the Internet and access sites for information. • Can teach others basic telecommunications skills.	• Advanced and frequent user of the Internet. • Can locate, download and install software from the Internet. • Can design and publish a web site. • Participates in on-line forums, newsgroups.

CURRICULUM INTEGRATION OF COMPUTER TECHNOLOGY

☑ **Special instructions for teachers with limited or no access to hardware and software: please respond to this category by indicating what you would do if you had adequate resources.**

LEVEL	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5
	• Do not use computers in the classroom.	• Manage the use of computers in the classroom but do not integrate them. • Students use computers independently without much guidance.	• Use computers in the classroom for various tasks and enrichment. • Have basic knowledge of and use various educational programs. • Teach basic computer skills to students.	• Integrate use of the computer into some content areas. • Know and use many educational programs. • Provide students with more advanced skills. • Use the Internet and multimedia applications to some degree.	• Fully integrate computers in the classroom. • Teach students advanced skills. • Can teach others how to integrate computers in the classroom. • Can evaluate software for sound pedagogical use.

TOTAL ALL 7 BOXES	DIVIDE BY 7	PROFILE SCORE Round to Whole Number	CLASSIFICATION (see chart on right)
	÷ 7	=	=

CLASSIFICATIONS

1 Non-user
2 Novice
3 Basic
4 Advanced
5 Expert

TEACHER DEVELOPMENT INTEREST

Please describe your interest in professional development opportunities in technology.

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ONLINE RESOURCES FOR TECHNOLOGY PLANNERS

Compiled By John Thurlow

The links below can be accessed at: http://home.maine.rr.com/smlc/resources.html

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The RAND Report on Technology and Teacher Professional Development
http://www.ed.gov/Technology/Plan/RAND/Teacher.html

Project Constellation at Rice University
http://cherokee.cs.rice.edu/constellation/

The Electronic Community of Teachers
http://ecot.rice.edu/index.html

EdResources (commercial site)
http://www.edresources.com/spclprog/prodev/index.htm

Curriculum Technology Educators: Online Technology Survey by Suzanne Sierra
http://www.cte-inc.com/TOTusesurvey.html

Professional Development for Technology Integration
http://www.ac.wwu.edu/~kenr/TCsite/plan.html#sec3

Technology Needs Assessment Survey
http://www.ed.gov/pubs/EdTechGuide/appc-5.html

Cherry Creek School District Staff Development Model
http://www.nsba.org/itte/cherry.html

The Role of Online Communications in Schools: A National Study
http://www.cast.org/publications/stsstudy/

New Developments in Staff Development by Douglas S. Fleming
http://carei.coled.umn.edu/ResearchPractice/v4n1/NDiPD.html

National Staff Development Council: Standards for Staff Development
http://www.nsdc.org/list.html

21st Century Teachers Network
http://www.21ct.org/

Technology Planning to Support Education Reform Information and resources to support the integration of technology into State Planning for Educational Reform under Goals 2000
http://www.fwl.org/techpolicy/g2guide.html

EdMin Open Systems
http://www.edmin.com/toolbox.html#tnas

Maturity Model Benchmarks Survey version 2.5
http://www.edmin.com/mmbs.html

Hardware Inventory Surveys version 2.2
http://www.edmin.com/his.html

Technology Needs Assessment Survey version. 2.3
http://www.edmin.com/toolbox.html#tnas